

REMARKS

The Official Action and the cited references have been carefully reviewed. The review indicates that the claims, especially as amended, recite patentable subject matter and should be allowed. Reconsideration and allowance are therefore respectfully requested.

Prior to contending with the grounds upon which the rejections have been made, a brief summarization of the essentials of the invention process will be given to establish a clearer line of distinction between the invention process and those processes disclosed in the cited and applied references.

Applicants' are the first to provide a process for making fuel or chemicals from a biomass hydrolysate without overliming the hydrolysate to a pH greater than 10, to avoid degradation of the fermentable carbohydrate fraction, to detoxify the biomass hydrolysate, to provide a process of converting the hydrolysis liquor without first diluting the liquor as a component of the medium, and to improve the product yield of ethanol or lactic acid in a microbial chemostat process.

This has unexpectedly been accomplished by:

- (a) providing a biomass hydrolyzate;
- (b) Adjusting pH of said biomass hydrolyzate within a range of 6 – 10.0;
- (c) contacting a metal oxide selected from the group consisting of titanium dioxide, vanadium oxide, and zirconium oxide having an affinity for guaiacyl or syringyl functional groups or both with said biomass hydrolyzate for a time sufficient to form an adsorption complex comprising a compound consisting essentially of phenol compounds obtained from lignin and a dissolved sugar fraction wherein the amount of metal oxide is twice to 4:1 the

weight ratio of said phenol compounds obtained from lignin;

(d) removing the adsorption complex; and

(e) converting the dissolved sugar fraction into a fuel or chemical using a microorganism selected from the group consisting of *r. Zymomonas mobilis*, *Saccharomyces cerevisiae* *D₅A*, or *Lactobacillus rhamnosus*.

Claims 1, 3, 5 and 10 were rejected as being anticipated by Perego et al. under 35 USC 102(b).

Applicants respectfully traverse the rejection and request reconsideration for reasons hereinafter set forth.

A careful review of Perego et al. shows that it only disclose a process for producing ethanol in which (i.e. overliming allows fermentation at 30%-50% liquor concentration). In particular, the ethanol is produced by overliming pretreatment followed by a secondary treatment in a column filled with Si-Al; and while fly ash may be used to discern the effects of pentose as well as inhibitor concentrations on the overall ethanol yield, no where in Perego et al. is there any mention of or reference to, the use of a metal oxide (such as titanium dioxide) per se in the amounts required by applicants nor the use of *r. Zymomonas mobilis*, *Saccharomyces cerevisiae* *D₅A*, or *Lactobacillus rhamnosus* for making the fuel or chemicals.

The fact that the fly ash used may comprise a minuscule amount TiO₂; namely, about 1.35% by weight of TiO₂ is clearly insufficient to render applicants' claims as presently amended anticipated.

Withdrawal of the rejection is respectfully requested.

Claims 1, 3 and 5-10 were rejected as being unpatentable over Perego et al. in view of Jeffries et al. and Leonard et al. under 35 USC 103(a).

Applicants respectfully traverse this rejection and request reconsideration for reasons hereinafter set forth.

Perego et al. has been discussed above; however, it is worthwhile repeating that Perego et al. uses an overliming process for purposes of identifying the best procedure for hemicellulose hydrolysate fermentation so as to gain greater knowledge of the nature of the inhibitors contained in the hemicellulose hydrolysate material, and sets up a process for its continuous fermentation using the microorganism Pachysolen Tannophilus NRRL Y 2460 to convert the dissolved sugar pentose into ethanol. As stated in the abstract of this reference, the best combination uses overliming pretreatment followed by a secondary treatment in a column filled with the SiAl material in order to obtain ethanol in an increased concentration of about 15%.

These deficiencies of Perego et al. are not compensated for by any teachings in the secondary references of Jeffries et al. and Leonard et al.

This is so because, Jeffries et al. only disclose a method of producing ethanol from fermentation of xylose comprising:

Culturing a mutant yeast strain in a xylose-containing material under suitable fermentation conditions for a period of time sufficient to allow the fermentation of xylose to ethanol, wherein the mutant yeast strain ferments xylose to produce ethanol at a high level relative to the corresponding wild-type yeast, and wherein the mutant yeast strain has reduced expression of functional cytochrome c, relative to the corresponding wild-type yeast. Although the xylose-containing material may comprise a hydrolysate of a lignocellulosic material, the thrust of Jeffries et al. is to provide a yeast strain capable of fermenting xylose at higher rates to produce greater yields of ethanol relative to that typically obtained by xylose fermenting yeast strains known to the art, as indicated in column 1, lines 57-60. And while FIGS. 7A or 7B as well

as FIG. 7C show higher yields of ethanol using soft wood hydrolysate than the hydrolysate of hard wood, there would be no incentive for or reason why one skilled in the art using the overliming process on hemicellulose hydrolysates prepared from hardwoods in Perego et al. to ascertain maximal ethanol yield, to look to Jeffries et al. for a substitute of softwood, as this would be diametrically opposite to the clearly enunciated objective of ascertaining maximal ethanol yield using the overliming process on a hardwood hemicellulose hydrolysate material of Perego et al.

Leonard et al. is also deficient but for the different reason that it disclose fermentation of wood sugars to ethyl alcohol, comprising:

Fermentation of wood sugars by yeast; wherein the fermentability of wood hydrolysates is either by the addition of reducing agents or heating neutral solutions; however, dissolved calcium sulfate must be decreased by neutralization at 140°C., crystallized, and filtered at that temperature followed by steam distillation to remove toxic constituents from the hydrolysates.

Consequently, even though Leonard et al. may utilize *Saccharomyces cerevisiae* as the microorganism in its fermentation of wood sugars to ethanol, Leonard et al. stresses that it is the reducing agents or heating the neutral solution that provides the most successful fermentation. Accordingly, even if the *Saccharomyces cerevisiae* microorganism of Leonard et al. were combined with Jeffries and Perego et al. applicants' process for making fuel or chemical from biomass hydrolysate would still not result for at least the reason that, applicants' process steps in (c) and (d) would not be met. Further, such a combination would not render applicants' invention obvious as none of these references alone or in combination utilize a metal oxide having an affinity for guaiacyl or syringyl functional groups or both in amounts sufficient to form an absorption complex of phenol compounds obtained from lignin and a dissolved sugar fraction,

wherein the amount of metal oxide is twice to 4:1 the weight ratio of said phenol compounds obtained from lignin.

Withdrawal of the rejection is respectfully requested.

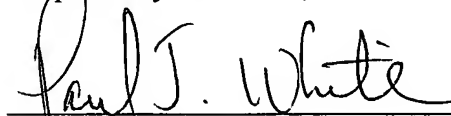
Note is taken to the objection raised to claim 8; however, in view of the amendments made to this claim, the objection is no longer applicable.

Note is also taken of the rejection of claims 3 and 5-9 under the 2nd paragraph of 35 USC §112; however, in view of the amendments made to these claims, the rejection is no longer applicable. With regard to claim 6, applicants would point out that the use of "r" before the *Zymomonas mobilis* or any other microorganism is well known to mean recombinant – accordingly, the word recombinant should not have to be spelled out. But in any case, since claim 6 has now been canceled, the rejection is now obviated.

In view of the foregoing amendments, remarks and arguments, it is believed that the application is now in condition for allowance and early notification of the same is earnestly solicited.

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Respectfully submitted,



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